The Farming system modelling and Conservation Agriculture (CA) adoption: intensification, risks, resilience and strategies: an example in the Lake Alaotra in Madagascar.

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Introduction

Livelihood analysis integrates a farm and an household where farming, non-farming activities, livelihood requirements and expenses are taken into account to understand the real “strategies” behind decisions on production factors allocation. CA adoption is a real change of paradigm: i) a move to new agricultural practices based on sustainability and ii) what may be far more important, a move to a mid or long term strategy. Therefore, we consider CA adoption as a move from a short term “annual crop based” traditional combination to a mid-term “perennial strategy of new annual crop combination”. Besides the traditional “short term” vs “long term” strategies, we emphasize as well the concept of “defensive“ vs “offensive” strategies based on farmers’ reactivity to constraints and opportunities. Adopting CA is clearly “offensive”, either to move from “mining” agriculture to sustainable agriculture (with focus on stability and resilience) or to boost agricultural production (securing ecological intensification). Therefore, farming system modeling is used to measure impact of CA adoption and forecast impact of various development scenarios.

Figure 1: Cash of the farmer balance before the shock

Material and Methods

The modelling tool used “Olympe” (INRA/CIRAD/IAMM) (Attonaty *et al.*, 1999), is based on a “step by step” simulation approach and scenario building, in order to test technical changes and impact on farm income, farm labour, and strategies on production factors allocation. The software Olympe is used to manage a Farming System Reference Monitoring Network (FSRMN). The approach has no defined automatic “rules”: the decision is based on a “manual” choice of technologies by local participants. The FSRMN, which was originally composed of 48 farms from 2007 to 2009, now has 15 farms in 2010/2011, representative of each type of the typology. Only one scenario, from 2010/2011, is presented although more than 50 scenarios have been prepared, by local development teams, between 2008 and 2011.

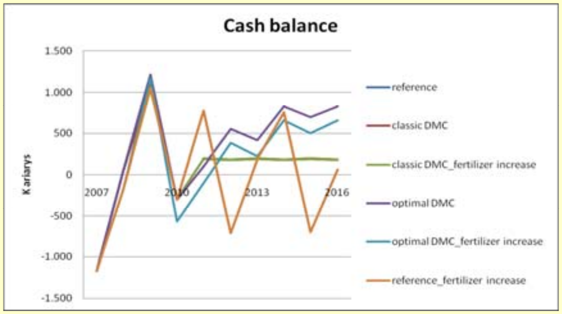

Figure 2: Cash balance of the farmer after an Increase in fertilizer prices by 50%

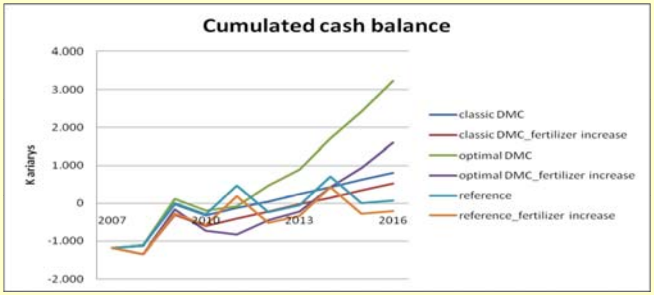

Figure 3: Comparison CA and conventional systems

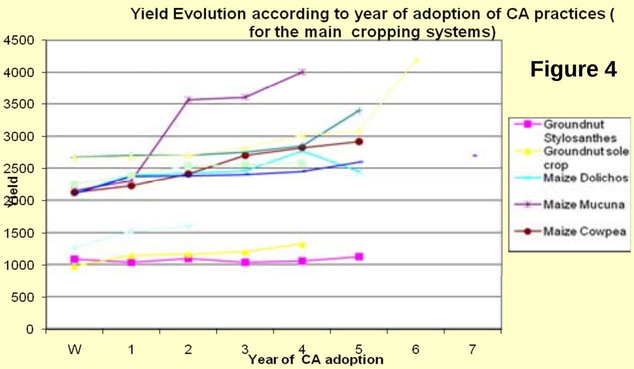

Figure 4

Results and discussion

In this example, the selected farming system from the Lake Alaotra area is based on groundnut and cassava production with fallow. The farmer is interested in any cropping system that eliminates fallow. In the first trajectory, the farmer replaces 1 ha of its conventional low input upland crops with 1 ha of CA “classical” maize-cowpea/rice system (in red). The second trajectory is based on a maize-cowpea /rice rotation system (in green : considered as “optimal”). The change in cropping system (in red) allows the farmer to have a more stable cash balance over time. The accumulated balance (after all expenses) significantly increased which ultimately allows him to capitalize and invest. The second trajectory stabilizes the cash balance then increases it. It appears to be eventually a more interesting strategy than the previous one (Figure 1).

The first “hazard” tested is the impact of fertilizers price (prices doubled in 2008), leading all farmers to eliminate fertilizers : 50 % in 2009/2010, and zero in 2010/2011. Meantime, the monitoring of 3 000 CA plots by BV-lac suggest that so far, yields did not decrease showing a certain “inertia” in the system (see figure 4). Simulation may help to identify the economic threshold concerning chemical fertilizers. Figure 2 shows the impact of higher fertilizer prices on annual cash balance. Despite 50% price increase, the “intensive” trajectory remains the most interesting. However farmers clearly opted for “zero fertilizer” option (fear to loose the investment). The “optimal” CA pattern remains a more resilient system than the “classic” CA pattern, with a better accumulated cash balance (Figure 3). The results of these scenarios challenge the abandonment of intensification techniques by farmers. The second scenario in based on both fertilizer price increase and rice price as frequently observed in the least 10 years (Figure 3).Where shocks are cumulative, once again the second trajectory seems to provide the best results: better farm resilience and cash flow due to production stability. This reduces farm vulnerability to shocks providing a better “cash safety net” against more shocks as long as yields are not affected by strong climatic events. Climatic risk is high in this area and might jeopardize intensification effort, CA systems have proven since 2003 to have a certain “buffer effect” to overcome climatic constraints.. Poor cash availability, prices volatility and fear of credit non-reimbursement drives farmers to a non intensification policy. They do favor yield stability with CA practices and eventually better cummulated production levels after 10 years as fallow has disappeared

Conclusion

Poor cash availability, prices volatility and fear of credit non-reimbursement, drives farmers to a non intensification policy to decrease economic risksn after achieving food security. They do favor yield stability with CA practices and eventually higuer cumulated production levels after 10 years as fallow has disappeared. The combination of both climatic risk and economic risk restrains farmers from securing more production through combining CA and intensification. However, after 7 years of adoption, many farmers recognize that CA practices do stabilize production as a whole (as recorded by project databases), despite this risk is still considered too high (or is it too early in the adoption process?) to use both CA and intensification in such a volatile economic context.

References

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